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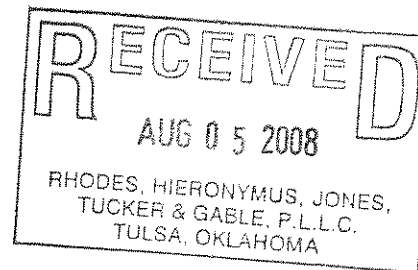
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August 5, 2008

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Re: Eratta Sheet for the Expert Report of Dr. J. Stevenson

Dear Leslie,

Please find attached the Errata Sheet for the Expert Report of Dr. J. Stevenson for distribution to defense counsel. If you have any questions, please give me a phone call.

Very Truly Yours,

*David P. Page / DPP*

David P. Page

DPP/sdk

Enc.

1 Errata for: Nutrient Pollution of Streams  
2 in the Illinois River Watershed, Oklahoma:  
3 Effects on  
4 Water Quality, Aesthetics, and Biodiversity

5  
6 Expert Report of Dr. R. Jan Stevenson

7 For

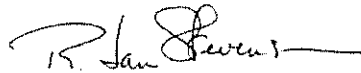
8 State of Oklahoma

9 In

10 Case No. 05-CU-329-GKF-SAJ

11 State of Oklahoma v. Tyson Foods, et al.

12 (In the United States District Court for the Northern District of Oklahoma)  
13

14 

15 Dr. R. Jan Stevenson  
16 Professor of Zoology  
17 Aquatic Ecologist

The words to alter in text are either indicated by italics or “”, depending on ease to distinguish italics in the directions for errata.

#### **Errata clarifying or correcting information**

Change original Figure 1.3 to Figure 1.4  
 Change original Figure 1.4 to Figure 1.3  
 Change *Vollenweider (1966)* to *Volleweider (1968, 1976)* in line 41 on page 7.  
 Change *spring* to *summer* in line 5 on page 18.  
 Change *Figure 2.21* to *Figure 2.25* in line on page 22.  
 Change *Figure 2.19* to *Figure 2.24* in line 33 on page 23.  
 Change *Table 2.3* to *Table 2.2* in line 2 on page 25.  
 Delete *Fig. 2.22* in line 3 on page 25.  
 Change *landscape contamination* to *poultry house density per square mile for the watershed* in line 27 on page 28.  
 Change *Table 3.1* to *Table 3.2* in line 7-8 on page 34.  
 Insert *individuals* in line 12 on page 34.  
 Insert *Under the same conditions* before *There* in line 27 on page 34.  
 Insert *(Figure 3.3)* after *analysis* in line 3 on page 35.  
 Change *SUMNUTEMMI* to *SNMMI* in paragraph 2 on page 41.  
 Change *Table 4.3* to *Table 4.4* in line 4 on page 41.  
 Insert *they* after *and* in line 13 on page 42.  
 Change *were the subset* to *made up the subset* in line 28 on page 43.  
 Change “, poultry houses are” to “from poultry houses is” in lines 2-3 on page 46.  
 Insert *in the IRW* after *higher* in line 26 on page 46.  
 Insert *poultry house density* before *coefficient* in line 4 of title for Table 3.3.  
 Insert “*a*” after “*DO is*” and insert “*an*” after “*expect*” in line 2 of title for Tables 3.4-3.7.  
 Change *set and* to *set at* in line 5 of title for Tables 4.2 and 4.3.  
 Change number for “Table 4.3 Correlations between relative abundances” to “Table 4.4 Correlations between relative abundances”.

#### **Errata that are largely grammatical or typographic errors.**

Insert “, 1989” after “1985” in line 40 on page 8.  
 Change *between* to *with* in line 2 on page 10.  
 Insert *used in* after *assemblages* in line 31 on page 10.  
 Insert *in Ohio* after *sites* in line 31 on page 11.  
 Change *some IRW streams* to *any IRW streams studied*.  
 Insert *them* after *grouped* in line 33 on page 21.  
 Change spelling of *Mougeotia* by dropping the *r* in line 38 of page 21.  
 Delete parentheses around *Cladophora*, *Rhizoclonium*, and *Oedogonium* in lines 7-8 on page 22.  
 Add – *Spring 2007* to end of header in line 25 on page 24.  
 Add – *Spring 2007* to end of header in line 4 on page 25.  
 Delete *than summer* in line 3 on page 26.  
 Change *a difference in* to *an* in lines 11, 16, and 21 on page 26.  
 Insert *with* after *correlated* in line 16 on page 27.  
 Insert *more* after *or* in line 15 on page 30.  
 Insert *sites* after *reference* in line 21 on page 31.

Change the “,” after land use to “and” in line 20 on page 33.  
 Change *summer* to *spring* after during in line 12 on page 35.  
 Delete *stressors* in line 32 on page 37.  
 Delete *either* in line 3 on page 38.  
 Change *were* to *was* in line 26 on page 40.  
 Change *the* to *then* in line 39 on page 43.  
 Change *lowest* to *low* in line 3 of Tables 5.2 and 5.3.

**Add the following references for citations that were in the text, but not properly referenced.**

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**The rationale for the Section 5 errata is the linear regression method of calculating current condition and percent changes in TP concentrations over the next 50 years under different management scenarios was not as accurate as the revised methods that are detailed in the Section 5 errata.**

The errata for Section 5 are presented as edited text with marked changes to make review of the errata easier. In one case, I used the strikethrough feature to show deletion. This was done to delete the old calculation methods for current condition and percent change in TP concentrations in the future scenarios. If I used the regular deletion method in track changes, the deleted section would have been difficult to find and read.

## Section 5

### Historical and Future Injury

#### 5.1 Introduction and Methods

An objective of this study was to estimate reductions in TP concentrations that could be expected in the IRW under different management scenarios and relate them to the change in percent of the IRW watershed that would be injured for aesthetics and fish species composition under each scenario. In addition, I evaluate the likely differences in injury related to historic conditions in the watershed.

Historic and future P loads in the IRW were predicted using processed-based watershed models in the Expert Witness Report of Dr. Bernard Engel. TP loads in the Illinois River at Tahlequah, Baron Fork, and Caney Creek were predicted in one historic and 4 future scenarios. These are three major branches within the IRW, and they vary considerably in size. Historic conditions were reconstructed from 1950 to 1999. Four future scenarios were simulated for at least 50 years:

- Control – no change in management practices;
- No litter application in the future;
- No litter application and development of riparian buffer strips; and
- Growth based on the recent history of activities by the poultry industry.

The predicted discharge (cfs) and P loads (kg/d) simulated in the future scenarios were converted into TP concentrations. Engel includes the historic P concentrations in the Illinois River at Tahlequah, Baron Fork, and Caney Creek in his report.

I compared the simulated change in TP concentrations during the last 50 years and over the future 50 years to current conditions in the IRW to determine the change in percent of streams that are injured by P pollution. First, I selected two benchmarks for injury by P. The TP threshold for FGA cover, 0.027 mg TP/L, was selected as a benchmark for TP above which considerable risk of injury to aesthetics occurs. This benchmark has considerable support from observations in other studies as well (Dodds et al. 1997, Stevenson et al. 2006) in which 0.030 mg TP/L was identified as a benchmark for nutrient criteria. This benchmark was applied to spring TP conditions when nuisance FGA blooms occur. I also selected the TP thresholds at which at least three studies have found substantial evidence that fish communities are injured, 0.06 mg TP/L (Miltner and Rankin 1998, Wang et al. 2007, Weigel and Robertson 2007). This benchmark was applied to summer conditions when we found evidence of fish responses to poultry house activities and nutrients. Thus, spring model data (March 15 thru June 15) were used to assess aesthetics injury associated with nuisance blooms of FGA cover. This is the most likely period for FGA blooms. Summer model data was selected from June 16 thru September 15 to characterize annual summer TP conditions that could cause injury to fish species composition.

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Simulations of TP concentration varied considerably over time because they included daily, seasonal, interannual, and long-term variability in weather conditions. To determine the central tendency of the changes in TP concentration in the four management scenarios, three locations, and two seasons, I used long-term averages of TP concentrations predicted in Engel's models. Thus, 24 averages were calculated to estimate TP concentrations in 2057 for future scenarios. Each average ( $TP_{s-avg,i,j}$ ) for 2057 was calculated with TP concentrations predicted with Engel's model with data selected during spring (March 15-June 15) and summer (June 16-Sept 15) seasons for the period 2047-2067, where s-avg ranged from 1-4 for the four management scenarios, i ranged from 1-3 for the three IRW sub-basins/locations, and j ranged from 1-2 for the two seasons. This 2047-2067 period was assumed to be sufficient to account for the great interannual variation in average TP concentrations predicted and provide accurate estimates of average 2057 TP concentrations for the 24 scenario-subwatershed-season conditions, because it was at the mid-point of the 2047-2066 period. I chose two decades on either side of 2057 because TP concentrations were strongly affected by variations in runoff and discharge, which were repeated over 10 year periods (2007-2016, 2017-2026, etc) in Engel's models.

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I had to estimate the average TP concentrations for the 2057-2067 period in the growth scenario because this scenario was only modeled for 50 years. I made this estimate by determining the percent changes in TP concentrations during successive decades in the 2007-2057 periods separately for spring and summer periods. Because these percent changes decreased over time, I took the average of percent changes for the 2037-2047 and 2047-2057 periods for each subbasin and applied that percent change to the average of the 2047-2057 period to determine the average TP concentration for the growth scenario in each subbasin (j=1-3) during both spring and summer.

Changes in modeled TP concentration varied relatively little in the control management scenario in which litter application was assumed to continue at the same rate over the next 50 years. Therefore, I used the average TP concentrations predicted with Engel's models for the control scenario from 2007-2027 for the Illinois River, Baron Fork, and Caney Creek for spring and summer to estimate current conditions. I assumed these three averages  $TP_{0,j}$  (where 0 indicates current time and j is 1-3 for the three subbasins) were better and more comparable estimates of current conditions than the measured TP concentrations because of the long-term variability that was accounted for in Engel's models.

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The percent changes in TP concentrations for the four management scenarios, three major sub-basins of the IRW, and two seasons ( $\%TP_{s-avg,i,j}$ ) were determined by comparing TP concentrations predicted in 2057 and current TP concentrations using the following equation:

$$\%TP_{s-avg,i,j} = (TP_{s-avg,i,j} / TP_{0,j} - 1) * 100$$

Then IRW-wide average percent changes in TP concentrations ( $\%TP_{IRW,s-avg,j}$ ) for the four management scenarios (s-avg=1-4) and two seasons (j=1-2) were determined with a flow-weighted average of percent changes in subbasins ( $\%TP_{s-avg,i,j}$  averages) with the following equation:

$$TP_{IRW,s-avg,j} = \sum_i TP_{s-avg,i,j} * Q_{avg,i} / 3$$

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$Q_{avg,j}$  was the average discharge in the three sub-basins ( $j=1-3$ ) over the 2007-2017 period. Again, I chose a 10 year period because this was the period over which discharge patterns were repeated in Engel's models.

Changes in modeled TP were relatively linear over time. However, variation around the line often increased under certain conditions. Further study of that variation phenomenon was beyond the scope of this study and did not interfere with the multi-year estimates of TP change needed for this study.

The 12 regression models for the four future scenarios, two seasons, and three IRW locations were used to predict the average change in TP concentrations from 2008 to 2058. Their general form was

$$TP_{avg} = \alpha + \beta (\text{year} * 10000)$$

Here  $TP_{avg}$  was the average TP concentration of the predicted daily concentration with the watershed models for either spring or summer. The regression models had to be calculated with year divided by 10,000 because the coefficients were so small that they appeared as zeros in the output if year was not transformed. This is easily corrected in the calculation of TP concentration. I did not log-transform TP concentration because it was more important to get an accurate prediction of the percent reduction in TP than to determine statistical significance of the relationship. The regression models were used to calculate expected TP concentration in either spring or summer of both 2008 and 2058. The percent change in TP concentration from 2008 to 2058 was determined for each of the 12 season-site-scenario conditions. The average percent change for each site-scenario combination was calculated with the 3 predicted changes for the three sites in the IRW. This was justified despite the great variability among predicted changes because the differences among sites were relatively systematic.

The average percent change for each season-scenario combination was used to calculate changes in TP concentrations in the 96 3<sup>rd</sup> order subwatersheds that were sampled during summer 2006. These 96 subwatersheds were part of a pool of the 336 3<sup>rd</sup> order subwatersheds that were delineated and characterized for land use. The 96 subwatersheds were the subset that was accessible by road for sampling. Details about the sampling and results can be found in the Expert Witness Report by Roger Olsen. The percent change for each of the four spring and four summer scenarios was applied to the TP concentration of each watershed to calculate the average TP concentration expected in a subwatershed in 2057.

The change in percent of the IRW watersheds that was injured (roughly equivalent to percent stream miles injured) under the four management scenarios was determined by ranking the 96 subwatershed sites by their TP concentrations in 2006 and the TP injury benchmarks (0.027 mg TP/L for algal blooms and aesthetics and 0.060 mg TP/L for fish species composition). All 96 subwatersheds were ranked by TP concentration in Tables 5.1 & 5.2. The percentile of the site with the lowest TP concentration that exceeded the TP injury benchmarks was determined from the tables. For example, if we ranked 100 sites with TP concentrations ranging from 1 to 100, and each was successively higher (e.g. 1, 2, 3 ... 100), then 40 percent of the sites would have a TP concentration greater than 60. Since TP concentrations changed proportionally from 2007 to

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2057, with the percent change factors for the different scenarios, ranking of sites did not change under the different scenarios.

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## 5.2 Results and Discussion

### 5.2.1 Historic Conditions

Finding: Historic TP concentrations, as late as 1950, would not have supported the frequent nuisance accumulations of FGA observed today.

Historic P conditions in the Illinois River at Tahlequah during the spring and summer increased from a predicted concentration of less than 0.030 mg TP/L to between 0.100 and 0.120 mg TP/L in 1999 (Dr. Bernard Engel's Expert Witness Report). Summer P concentrations were predicted to be slightly lower than spring P concentrations. Predicted changes in P concentrations in the Baron Fork during the spring were less, ranging from less than 0.010 mg TP/L in 1950 to about 0.120 mg TP/L in 1999. Results from the Caney Creek were not used because of dry periods during summer conditions.

The increases in nutrient concentrations in the Illinois River at Tahlequah indicate that nutrients were low enough that extensive FGA cover would have been rare in 1950. The risk of nuisance FGA cover that would alter aesthetics and habitat for biodiversity increased greatly from 1950 to 1999. Oklahoma State phosphorus criterion for aesthetics use was predicted to be exceeded by the late 1950s in the Illinois River at Tahlequah. The probability of extensive FGA is great when TP concentrations are as high as 0.100 mg/L (Stevenson et al. 2006). Aesthetics problems would not have been as great in the Baron Fork. However, local problems within the Baron Fork watershed were likely where P loading was sufficient to increase P concentrations in small streams, but not in the main branch of the Baron Fork where P would become diluted and processed biologically.

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The increases in nutrient concentrations in the Illinois River at Tahlequah and the Baron Fork indicate that nutrients were low enough that little risk to fish species composition from nutrient pollution existed in 1950. However, in the Illinois River, the increase in P concentrations exceeded the benchmark for fish effects, 0.060 mg TP/L, during the early 1970s.

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Based on summer 2006 sampling of 96 3<sup>rd</sup> order subwatersheds in the IRW, 47 percent exceeded the fish benchmark for injury; and assuming that TP concentrations were at least as high during the spring as summer, aesthetics of 83 percent of streams were injured with TP concentrations higher than the 0.027 mg TP/L benchmark (Tables 5.1 and 5.2). Seventy-four percent of the 3<sup>rd</sup> order subwatersheds would have exceeded the 0.037 mg TP/L criterion set by the State Oklahoma (OWRB 2005).

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### 5.2.2 Future Scenarios

Land use was characterized in 332 of the 336 3<sup>rd</sup> order subwatersheds of the IRW. The median poultry house density in watersheds was 1.375 houses/mi<sup>2</sup>, with a minimum of 0, maximum of 7.095, and 25<sup>th</sup> and 75<sup>th</sup> quartiles of 0.267 and 3.717 houses/mi<sup>2</sup> (Figure 5.1). The median of urban land use was 4.67 percent of subwatersheds, with a minimum of 0.375, maximum of 88.847, and 25<sup>th</sup> and 75<sup>th</sup> quartiles of 3.142 and 7.59 percent. The median of percent agricultural

land use was 44.4 percent of watersheds, with a minimum of 0, a maximum of 88.0, and 25<sup>th</sup> and 75<sup>th</sup> quartiles of 23.5 and 59.6 percent. In summary, most of the 3<sup>rd</sup> order subwatersheds had less than 10 percent urban land use and low poultry house densities. The land use characteristics of the subset of 96 3<sup>rd</sup> order subwatersheds that had measured TP concentrations during summer 2006 were similar to the land use characteristics of the full set of 332 3<sup>rd</sup> order subwatersheds of the IRW. It is my opinion that the estimates of subwatershed percentages injured in the subset 96 3<sup>rd</sup> order subwatersheds are representative of the injuries of stream miles throughout the IRW stream and river network, based on similarity of the land use characteristics of the 96 3<sup>rd</sup> order subwatersheds and the 332 3<sup>rd</sup> order subwatersheds plus other considerations of temporal and spatial variation in TP and nutrient effects on stream and river ecosystems.

*Finding: Thirteen percent more streams in the IRW would be injured in 50 years if growth of the industry continues as modeled. However, if litter application were halted and stream buffers were established, as many as 35 percent fewer streams would be injured. This represents a 48 percent difference in the number of watersheds injured in 50 years depending upon future management practices.*

Engel's processed-based watershed models showed decreases in both spring and summer TP concentrations over the next 50 years in IRW streams under no litter and no litter plus buffer scenarios (Tables 5.1 & 5.2). Estimated decreases in TP concentrations ( $\Delta TP_{IRW,s-avg,t}$ ) ranged from 44-51% over the next 50 years under litter and no litter plus buffer scenarios during spring and summer periods. TP concentrations over the next 50 years in Engel's models were predicted to increase by 118 and 126% during spring and summer respectively, if poultry activity growth continues at the recent pace. TP concentrations under control scenarios in Engel's models were predicted to remain the same over the next 50 years; the calculated percent increase between 3-4% was within the interannual variability simulated by the model. The percent reduction in TP concentrations was successively higher for no litter (-44 percent) and the no litter plus buffer (-50 to -51 percent) scenarios. Discussion of reasons for differences in reductions of average seasonal TP concentrations among scenarios is beyond the scope of this report.

The predicted changes in proportion of IRW subwatersheds injured due to P pollution ranged from a 36 percent increase to a 35 percent decrease (Tables 5.1 & 5.2). The growth scenario increased the percent of watersheds injured for spring aesthetics, from 83 to 96 percent having TP concentrations greater than 0.027 mg TP/L. During the summer, the percent of watersheds with greater than 0.060 mg TP/L increased from 47 to 83 percent according to the growth scenario.

The management scenario which could produce the greatest improvement in TP concentrations over the next 50 years was the no litter plus buffer scenario, although the no litter with buffer scenario was similar (Tables 5.1 & 5.2). The no litter plus buffer scenario could cause a reduction in percent subwatersheds injured for spring aesthetics from 83 percent in 2007 to 48 percent in 2057. The no litter scenario could cause a reduction in percent subwatersheds injured for spring aesthetics from 83 percent in 2007 to 56 percent in 2057. The greatest percent reduction in summer injury for fish species composition was from 47 percent in 2007 to 26 percent in 2057 with the no litter plus buffer scenario.

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Table 5.1. The expected average spring TP concentrations in the 96 representative watersheds in 2057 under different management scenarios. The TP concentrations during spring were assumed, conservatively, to be the same as during summer 2006. The percent change for each scenario is listed as well as the spring injury benchmark (0.027 mg TP/L). The numbers marked in bold are the site with lowest TP concentration that exceeded the spring injury benchmark.

Rank	100-Percentile	Summer 2006 TP (mg/L)	Spring 2057 (0.027 mg TP/L benchmark)			
			Control	No Litter	No Litter & Buffer	Continued Growth
			3.67 % <sub>y</sub>	-44.29 % <sub>y</sub>	-50.97 % <sub>y</sub>	118.45 % <sub>y</sub>
1	100.00	0.006	0.006 <sub>y</sub>	0.003 <sub>y</sub>	0.003 <sub>y</sub>	0.013 <sub>y</sub>
1	98.96	0.009	0.009 <sub>y</sub>	0.005 <sub>y</sub>	0.004 <sub>y</sub>	0.019 <sub>y</sub>
1	97.92	0.009	0.009 <sub>y</sub>	0.005 <sub>y</sub>	0.004 <sub>y</sub>	0.019 <sub>y</sub>
1	96.87	0.010	0.010 <sub>y</sub>	0.006 <sub>y</sub>	0.005 <sub>y</sub>	0.022 <sub>y</sub>
1	95.83	0.017	0.018 <sub>y</sub>	0.009 <sub>y</sub>	0.008 <sub>y</sub>	<b>0.037<sub>y</sub></b>
1	94.79	0.018	0.018 <sub>y</sub>	0.010 <sub>y</sub>	0.009 <sub>y</sub>	0.039 <sub>y</sub>
1	93.75	0.018	0.019 <sub>y</sub>	0.010 <sub>y</sub>	0.009 <sub>y</sub>	0.039 <sub>y</sub>
1	92.71	0.018	0.019 <sub>y</sub>	0.010 <sub>y</sub>	0.009 <sub>y</sub>	0.040 <sub>y</sub>
1	91.67	0.021	0.022 <sub>y</sub>	0.012 <sub>y</sub>	0.010 <sub>y</sub>	0.046 <sub>y</sub>
1	90.62	0.021	0.022 <sub>y</sub>	0.012 <sub>y</sub>	0.010 <sub>y</sub>	0.046 <sub>y</sub>
1	89.58	0.021	0.022 <sub>y</sub>	0.012 <sub>y</sub>	0.010 <sub>y</sub>	0.046 <sub>y</sub>
1	88.54	0.022	0.023 <sub>y</sub>	0.012 <sub>y</sub>	0.011 <sub>y</sub>	0.048 <sub>y</sub>
1	87.50	0.023	0.023 <sub>y</sub>	0.013 <sub>y</sub>	0.011 <sub>y</sub>	0.049 <sub>y</sub>
1	86.46	0.025	0.026 <sub>y</sub>	0.014 <sub>y</sub>	0.012 <sub>y</sub>	0.054 <sub>y</sub>
1	85.42	0.025	0.026 <sub>y</sub>	0.014 <sub>y</sub>	0.012 <sub>y</sub>	0.054 <sub>y</sub>
1	84.37	0.025	0.026 <sub>y</sub>	0.014 <sub>y</sub>	0.012 <sub>y</sub>	0.054 <sub>y</sub>
1	83.33	<b>0.029</b>	<b>0.030<sub>y</sub></b>	0.016 <sub>y</sub>	0.014 <sub>y</sub>	0.062 <sub>y</sub>
1	82.29	0.029	0.030 <sub>y</sub>	0.016 <sub>y</sub>	0.014 <sub>y</sub>	0.063 <sub>y</sub>
1	81.25	0.030	0.031 <sub>y</sub>	0.017 <sub>y</sub>	0.015 <sub>y</sub>	0.066 <sub>y</sub>
1	80.21	0.030	0.031 <sub>y</sub>	0.017 <sub>y</sub>	0.015 <sub>y</sub>	0.066 <sub>y</sub>
1	79.17	0.033	0.034 <sub>y</sub>	0.018 <sub>y</sub>	0.016 <sub>y</sub>	0.072 <sub>y</sub>
1	78.12	0.035	0.036 <sub>y</sub>	0.020 <sub>y</sub>	0.017 <sub>y</sub>	0.077 <sub>y</sub>
1	77.08	0.036	0.037 <sub>y</sub>	0.020 <sub>y</sub>	0.017 <sub>y</sub>	0.078 <sub>y</sub>
1	76.04	0.037	0.038 <sub>y</sub>	0.021 <sub>y</sub>	0.018 <sub>y</sub>	0.081 <sub>y</sub>
1	75.00	0.037	0.038 <sub>y</sub>	0.021 <sub>y</sub>	0.018 <sub>y</sub>	0.081 <sub>y</sub>
1	73.96	0.038	0.039 <sub>y</sub>	0.021 <sub>y</sub>	0.018 <sub>y</sub>	0.082 <sub>y</sub>
1	72.92	0.038	0.040 <sub>y</sub>	0.021 <sub>y</sub>	0.019 <sub>y</sub>	0.084 <sub>y</sub>
1	71.87	0.039	0.040 <sub>y</sub>	0.021 <sub>y</sub>	0.019 <sub>y</sub>	0.084 <sub>y</sub>
1	70.83	0.039	0.040 <sub>y</sub>	0.022 <sub>y</sub>	0.019 <sub>y</sub>	0.085 <sub>y</sub>
1	69.79	0.040	0.041 <sub>y</sub>	0.022 <sub>y</sub>	0.020 <sub>y</sub>	0.087 <sub>y</sub>
1	68.75	0.040	0.042 <sub>y</sub>	0.022 <sub>y</sub>	0.020 <sub>y</sub>	0.088 <sub>y</sub>

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1	67.71	0.040	0.042	0.022	0.020	0.088
Rank	100-Percentile	Summer 2006 TP (mg/L)	Spring 2057 (0.027 mg TP/L benchmark)			
			Control	No Litter	No Litter & Buffer	Continued Growth
			3.67 %	-44.29 %	-50.97 %	118.45 %
1	66.67	0.042	0.044	0.023	0.021	0.092
1	65.62	0.043	0.045	0.024	0.021	0.094
1	64.58	0.044	0.046	0.025	0.022	0.097
1	63.54	0.045	0.047	0.025	0.022	0.098
1	62.50	0.045	0.047	0.025	0.022	0.098
1	61.46	0.046	0.047	0.025	0.022	0.100
1	60.42	0.046	0.048	0.026	0.023	0.100
1	59.37	0.048	0.050	0.027	0.023	0.104
1	58.33	0.048	0.050	0.027	0.024	0.105
1	57.29	0.049	0.051	0.027	0.024	0.108
1	56.25	0.051	0.053	0.028	0.025	0.111
1	55.21	0.051	0.053	0.028	0.025	0.111
1	54.17	0.051	0.053	0.028	0.025	0.111
1	53.12	0.052	0.054	0.029	0.025	0.114
1	52.08	0.053	0.055	0.030	0.026	0.116
1	51.04	0.054	0.056	0.030	0.026	0.118
1	50.00	0.055	0.057	0.031	0.027	0.120
1	48.96	0.055	0.057	0.031	0.027	0.120
1	47.92	0.057	0.059	0.031	0.028	0.123
1	46.87	0.061	0.064	0.034	0.030	0.134
1	45.83	0.063	0.065	0.035	0.031	0.138
1	44.79	0.064	0.066	0.035	0.031	0.139
1	43.75	0.064	0.066	0.036	0.031	0.140
1	42.71	0.065	0.068	0.036	0.032	0.142
1	41.67	0.068	0.071	0.038	0.033	0.149
1	40.62	0.072	0.074	0.040	0.035	0.156
1	39.58	0.072	0.075	0.040	0.035	0.157
1	38.54	0.072	0.075	0.040	0.035	0.158
1	37.50	0.073	0.076	0.041	0.036	0.160
1	36.46	0.081	0.084	0.045	0.040	0.177
1	35.42	0.082	0.085	0.046	0.040	0.180
1	34.37	0.083	0.086	0.046	0.041	0.181
1	33.33	0.086	0.089	0.048	0.042	0.188
1	32.29	0.091	0.095	0.051	0.045	0.199

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1	31.25	0.093	0.097	0.052	0.046	0.204
Rank	100-Percentile	Summer 2006 TP (mg/L)	Spring 2057 (0.027 mg TP/L benchmark)			
			Control	No Litter	No Litter & Buffer	Continued Growth
			3.67 %	-44.29 %	-50.97 %	118.45 %
1	30.21	0.102	0.105	0.057	0.050	0.222
1	29.17	0.103	0.107	0.057	0.051	0.225
1	28.12	0.116	0.120	0.065	0.057	0.253
1	27.08	0.117	0.121	0.065	0.057	0.256
1	26.04	0.128	0.133	0.071	0.063	0.280
1	25.00	0.141	0.146	0.078	0.069	0.307
1	23.96	0.142	0.147	0.079	0.070	0.311
1	22.92	0.154	0.160	0.086	0.076	0.337
1	21.87	0.157	0.162	0.087	0.077	0.342
1	20.83	0.170	0.176	0.095	0.083	0.371
1	19.79	0.187	0.194	0.104	0.092	0.408
1	18.75	0.187	0.194	0.104	0.092	0.409
1	17.71	0.189	0.196	0.105	0.093	0.413
1	16.67	0.190	0.197	0.106	0.093	0.415
1	15.62	0.191	0.198	0.106	0.094	0.417
1	14.58	0.236	0.245	0.132	0.116	0.516
1	13.54	0.255	0.264	0.142	0.125	0.556
1	12.50	0.260	0.269	0.145	0.127	0.567
1	11.46	0.283	0.293	0.158	0.139	0.618
1	10.41	0.350	0.363	0.195	0.172	0.765
1	9.37	0.383	0.397	0.213	0.188	0.836
1	8.33	0.437	0.453	0.244	0.214	0.955
1	7.29	0.446	0.462	0.248	0.219	0.974
1	6.25	0.475	0.492	0.265	0.233	1.038
1	5.21	0.557	0.577	0.310	0.273	1.217
1	4.16	0.592	0.614	0.330	0.290	1.293
1	3.12	0.597	0.619	0.333	0.293	1.305
1	2.08	1.428	1.481	0.796	0.700	3.120
1	1.04	4.111	4.261	2.290	2.015	8.979

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Table 5.3. The expected summer average TP concentrations in the 96 representative watersheds in 2057 under different management scenarios. The percent change from summer 2006 for each scenario is listed as well as the summer injury benchmark (0.060 mg TP/L). The numbers marked in bold are the site with lowest TP concentration that exceeded the summer injury benchmark.

100- Percentile	Summer 2006 TP (mg/L)	Summer 2057 (0.060 mg TP/L)			
		Control	No Litter	No Litter & Buffer	Continued Growth
		3.32 %	-43.98 %	-50.31 %	126.17 %
100.00	0.006	0.006	0.003	0.003	0.014
98.96	0.009	0.009	0.005	0.004	0.020
97.92	0.009	0.009	0.005	0.004	0.020
96.87	0.010	0.010	0.006	0.005	0.023
95.83	0.017	0.017	0.009	0.008	0.038
94.79	0.018	0.018	0.010	0.009	0.040
93.75	0.018	0.019	0.010	0.009	0.041
92.71	0.018	0.019	0.010	0.009	0.041
91.67	0.021	0.022	0.012	0.010	0.047
90.62	0.021	0.022	0.012	0.010	0.047
89.58	0.021	0.022	0.012	0.010	0.047
88.54	0.022	0.023	0.012	0.011	0.050
87.50	0.023	0.023	0.013	0.011	0.051
86.46	0.025	0.025	0.014	0.012	0.056
85.42	0.025	0.025	0.014	0.012	0.056
84.37	0.025	0.026	0.014	0.012	0.056
83.33	0.029	0.030	0.016	0.014	<b>0.065</b>
82.29	0.029	0.030	0.016	0.014	0.066
81.25	0.030	0.031	0.017	0.015	0.068
80.21	0.030	0.031	0.017	0.015	0.068
79.17	0.033	0.034	0.018	0.016	0.075
78.12	0.035	0.036	0.020	0.017	0.079
77.08	0.036	0.037	0.020	0.018	0.081
76.04	0.037	0.038	0.021	0.018	0.083
75.00	0.037	0.038	0.021	0.018	0.084
73.96	0.038	0.039	0.021	0.019	0.085
72.92	0.038	0.040	0.021	0.019	0.087
71.87	0.039	0.040	0.022	0.019	0.087
70.83	0.039	0.040	0.022	0.019	0.088
69.79	0.040	0.041	0.022	0.020	0.090
68.75	0.040	0.042	0.023	0.020	0.091
67.71	0.040	0.042	0.023	0.020	0.091

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100-Percentile	Summer 2006 TP (mg/L)	Summer 2057 (0.060 mg TP/L)			
		Control	No Litter	No Litter & Buffer	Continued Growth
		3.32 %	-43.98 %	-50.31 %	126.17 %
66.67	0.042	0.043	0.024	0.021	0.095
65.62	0.043	0.044	0.024	0.021	0.097
64.58	0.044	0.046	0.025	0.022	0.100
63.54	0.045	0.046	0.025	0.022	0.102
62.50	0.045	0.046	0.025	0.022	0.102
61.46	0.046	0.047	0.026	0.023	0.103
60.42	0.046	0.048	0.026	0.023	0.104
59.37	0.048	0.049	0.027	0.024	0.108
58.33	0.048	0.050	0.027	0.024	0.109
57.29	0.049	0.051	0.028	0.025	0.112
56.25	0.051	0.053	0.029	0.025	0.115
55.21	0.051	0.053	0.029	0.025	0.115
54.17	0.051	0.053	0.029	0.025	0.115
53.12	0.052	0.054	0.029	0.026	0.118
52.08	0.053	0.055	0.030	0.026	0.120
51.04	0.054	0.056	0.030	0.027	0.122
50.00	0.055	0.057	0.031	0.027	0.124
48.96	0.055	0.057	0.031	0.027	0.124
47.92	0.057	0.058	0.032	0.028	0.128
46.87	<b>0.061</b>	<b>0.063</b>	0.034	0.031	0.139
45.83	0.063	0.065	0.035	0.031	0.143
44.79	0.064	0.066	0.036	0.032	0.144
43.75	0.064	0.066	0.036	0.032	0.145
42.71	0.065	0.067	0.037	0.032	0.148
41.67	0.068	0.070	0.038	0.034	0.154
40.62	0.072	0.074	0.040	0.036	0.162
39.58	0.072	0.074	0.040	0.036	0.163
38.54	0.072	0.075	0.040	0.036	0.163
37.50	0.073	0.076	0.041	0.036	0.166
36.46	0.081	0.084	0.045	0.040	0.183
35.42	0.082	0.085	0.046	0.041	0.186
34.37	0.083	0.086	0.046	0.041	0.188
33.33	0.086	0.089	0.048	0.043	0.195
32.29	0.091	0.094	0.051	0.045	0.206
31.25	0.093	0.096	0.052	0.046	0.211

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100-Percentile	Summer 2006 TP (mg/L)	Summer 2057 (0.060 mg TP/L)			
		Control	No Litter	No Litter & Buffer	Continued Growth
		3.32 %	-43.98 %	-50.31 %	126.17 %
30.21	0.102	0.105	0.057	0.051	0.230
29.17	0.103	0.106	0.058	0.051	0.233
28.12	0.116	0.120	0.065	0.058	0.262
27.08	0.117	0.121	0.066	0.058	0.265
26.04	0.128	0.132	0.072	0.064	0.289
25.00	0.141	0.145	0.079	0.070	0.318
23.96	0.142	0.147	0.080	0.071	0.322
22.92	0.154	0.159	0.086	0.077	0.349
21.87	0.157	0.162	0.088	0.078	0.354
20.83	0.170	0.175	0.095	0.084	0.384
19.79	0.187	0.193	0.105	0.093	0.423
18.75	0.187	0.193	0.105	0.093	0.423
17.71	0.189	0.195	0.106	0.094	0.427
16.67	0.190	0.197	0.107	0.095	0.430
15.62	0.191	0.197	0.107	0.095	0.431
14.58	0.236	0.244	0.132	0.117	0.535
13.54	0.255	0.263	0.143	0.127	0.576
12.50	0.260	0.268	0.145	0.129	0.587
11.46	0.283	0.292	0.158	0.141	0.640
10.41	0.350	0.362	0.196	0.174	0.792
9.37	0.383	0.395	0.214	0.190	0.865
8.33	0.437	0.452	0.245	0.217	0.989
7.29	0.446	0.461	0.250	0.222	1.008
6.25	0.475	0.491	0.266	0.236	1.074
5.21	0.557	0.576	0.312	0.277	1.260
4.16	0.592	0.612	0.332	0.294	1.339
3.12	0.597	0.617	0.335	0.297	1.351
2.08	1.428	1.476	0.800	0.710	3.231
1.04	4.111	4.247	2.303	2.042	9.297

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